**Chem 1984 Marathon problem #1**

**Metaphoric Atomic volumes**

**Due Monday 9 September 2013 by 4 PM**

**(no electronic submissions will be accepted)**

**10 points**

**DETAILED ANSWER ON BACK**

Use Google to look up the approximate volume of water in the Pacific Ocean. Assume that volume is occupied by the electronic cloud in a typical atom. If the atom’s nucleus and electronic cloud are both assumed spherical, so that their volumes, **V**, can be computed using equation **1** where r= the radius of either the nucleus or cloud:

1. **V= 4/3 \* π\*r3**

provide arguments, calculations and reasoning for whether the nuclear volume is best estimated by:

1. **The volume of a standard basketball:**

**V= 7.5\*103 cm3**

1. **The volume of water in a typical above ground swimming pool:**

**V ~5\*107 cm3**

1. **The volume of water in an Olympic class swimming pool:**

 **V~ 1.0\*109 cm3**

1. **Volume occupied by the Hindenburg Zeppelin:**

 **V~2\*1011 cm3**

**Assume: r(nucleus) = 10‑15 m r(electron cloud) =10-10 m**

Answer:

 **V(electron cloud)=** **~~4/3 \* π(~~10-10)3 = 10+15**

 **V(nucleus) ~~4/3\*π(~~10‑15)3**

**The estimated volume of the Pacific Ocean (from Wikipedia):**

**Vpacific =714\*106 km3 = 7.14\*108 km3**

**1 km3 = (1000)3 m3 = 109 m3 =109 (100)3 cm3 =1015 cm3**

**∴ Vpacific = 7.14\*108\*1015 =7.14\*1023cm3**

**If Vpacific  = V(electron cloud)=>**

 **V(electron cloud)=** **7.14\*1023 cm3 = 1015**

 **V(nucleus) V(nucleus) cm3**

* **V(nucleus) = 7.14\*1023 = 7.14 \*108 cm3**

 **1015**

**Comparing the above with the volumes below given in the problem:**

**Item V(cm3)**

**Basketball 7.5\*103**

**Above ground pool 5\*107**

**Olympic pool 1\*109 vs. 7.14 \*108 cm3 =0.7\*109**

**Hindenburg 2\*1011**